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Effects of water on the stress corrosion cracking of carbon steel in ethanolic media

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ABSTRACT

In this study, the effect of water on the stress corrosion cracking (SCC) of ASTM 516 in ethanol was investigated. Ethanol is hygroscopic in nature and its water content can increase rapidly when exposed to humid conditions. The presence of water in ethanol is likely to increase ethanol's oxygen content which is the major instigator of SCC.

In order to have an insight into the SCC susceptibility of carbon steel in ethanol-water solutions, the corrosion behaviour of the steel in these solutions was first evaluated. Carbon steel specimens in ethanol solutions with water exhibited various extents of localised corrosion, which increased in severity with increase in water content from 1 to 5 vol%. The occurrence of localised attack suggested that the presence of water promoted the formation of surface films; a condition suitable for SCC. Carbon steel specimens subjected to slow strain rate tests, however, exhibited ductile fractures indicating that the presence of up to 5vol% water did not induce SCC of carbon steel in ethanol.